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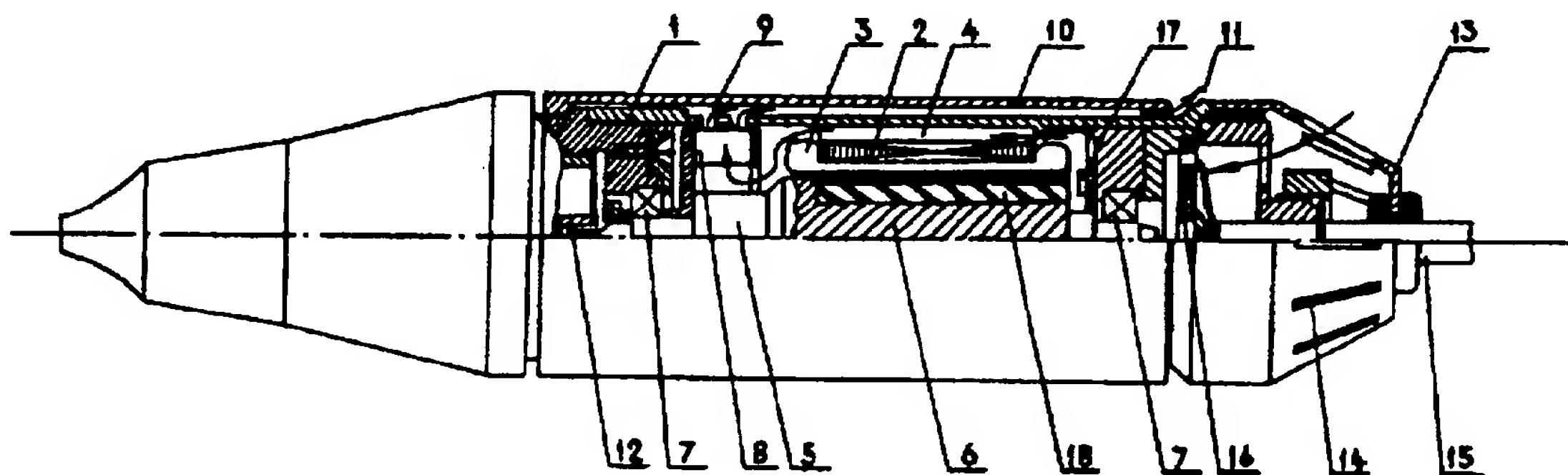
(56) Documents Cited by ISA  
DE 001566265 A SU 001727796 A1 US 3427720 A

(58) Field of Search by ISA  
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## (54) Dental drilling device

(57) The proposed dental drilling device comprises a cylindrical housing (1) on the inner surface of which is mounted the stator of a motor with the block of the armature (2) and winding (3) (e.g. triple-phase). The block of the armature (2) is provided with coaxial ventilation canals (4). The shaft (5) of the rotor (6) of the motor is mounted in two bearing assemblies (7); on the shaft (5) between the rotor (6) and the front bearing assembly is mounted a ventilator (8) for drawing in air from outside, and opposite the blades of the ventilator (8) around the periphery of the housing (1) are provided ventilating rows of apertures (9) through which cooling air can pass out along the ventilation channel formed by the skirt (10) on the housing (1) and the outer surface of the housing towards the annular slit (11). The tail end of the shaft (5) is hinged to the sleeve (12) of the coupling which ensures connection to the chuck in which the tool is held. Ventilation apertures are provided in the removable cap (13). A cable (15) insulated from the cap (13) passes through the latter to the assembly plate (16) fitted in the rear bearing assembly (7). Supply voltage is fed via the cable (15) to the assembly plate (16) and whence, via the system which controls the speed of the electrical motor (6), to the winding of the motor stator. The frequency of the voltage applied is strictly proportional to the rotational frequency of the rotor (6) and determined by signals from rotor position sensors (17) (e.g. Hall elements) fitted so as to leave a gap between themselves and the magnet (18) mounted on the rotor (6). The proposed design of dental drilling device reduces thermal loss, noise and vibration, increases the useful life of the device, makes it easier to maintain and simplifies the technology required for its manufacture.



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## DENTAL DRILLING ENGINE

### Technical Field

The present invention relates in general to medical engineering and more specifically to devices used in dental  
5 prosthetics.

### Background Art

Known in the present state of the art are dental drilling engines, comprising an enclosed electric motor whose shaft is linked, through a clutch, to a collet adapted  
10 to receive the working tool, current supply, control, and cooling systems (cf. USSR Patent 871,795, Cl. A61C 1/00).

The nearest to the technical solution proposed herein is the dental drilling engine as disclosed in USSR Inventor's Certificate No.158,376, Cl. A61C 1/00, which  
15 comprises a small-size d.c. commutator motor enclosed in a casing closed with a cover and a bush. A spindle accommodating a gripping collet is connected to the motor shaft through a clutch member, a pin, and a spring-actuated pusher. The dental engine in question, however, features an  
20 inadequately high tool rotation speed, too a high noise and vibration level, and insufficient cooling of the motor and casing.

### Disclosure of the Invention

The present invention has for its principal object to  
25 provide a high-speed dental drilling engine convenient in use and having a low noise and vibration level, whose construction allows of an efficient cooling of both the motor and casing.

The foregoing object is accomplished due to the fact  
30 that in a dental drilling engine, comprising a casing which accommodates a drive electric motor whose shaft is journaled in bearing units and is connected, through a clutch, to a collet for gripping the working tool, a detachable cover with a power cable brought to a wiring  
35 board located on the rear bearing unit, according to the invention, used as the drive electric motor is a brushless d.c. motor whose armature stack and stator winding are

provided with vent ducts and are located on the interior surface of the casing provided with a skirt that forms a vent duct together therewith. The shaft of the motor rotor carries a blower fan, and a number of vent holes are  
5 provided in the casing and the detachable cover. Rotor angular position sensors make a clearance with the rotor which carries an electromagnet.

The herein-proposed construction arrangement of the dental drilling engine that makes use of a brushless  
10 electric motor and specially provided vent ducts is substantially advantageous over the heretofore-known dental engines, that is, a speed restriction inherent in dental engines driven by commutator motors is obviated, heat losses, noise and vibration level are reduced, service life  
15 is extended, and cooling of the motor and exterior surface of the engine casing is ensured.

#### Brief Description of the Drawing

In what follows the present invention is illustrated in a detailed description of a specific exemplary embodiment  
20 thereof taken in conjunction with the accompanying drawing, wherein a general schematic view of the dental drilling engine is presented.

#### Best Method of Carrying Out the Invention

The dental drilling engine of the present invention  
25 comprises a cylindrical casing 1 whose interior surface carries the motor stator with the stack of an armature 2 and a winding 3 (e.g., a three-phase one). The stack of the armature 2 is provided with coaxial vent ducts 4. A shaft 5 of a motor rotor 6 is journaled in two bearing units 7. A  
30 blower fan 8 (e.g., a centrifugal one) is set on the shaft 5 between the rotor 6 and the front bearing unit for sucking in the ambient air to cool the motor. A number of rows of vent holes 9 are provided opposite to the blades of the blower fan 8 round the periphery of the casing 1, intended  
35 for the cooling air to pass along a vent duct established by a skirt 10 mounted on the casing 1 and the exterior surface

of the casing, towards a circular slit 11. The tail extension of the shaft 5 is joined, through a clutch 12, with a collet, wherein a working tool is gripped (both being omitted in the drawing). Vent holes 14 are provided in a detachable cover 13 for the ambient air to suck into the interior of the casing 1. A power cable 15 electrically insulated from the cover 13 runs therethrough to a wiring board 16 which is built into the rear bearing unit 7. Supply voltage is fed along the power cable 15 to the wiring board 16 and further, via the motor speed control system, to the motor stator winding 3.

The control system is instrumental in converting a primary mains voltage (220 V 50 Hz) into a preset d.c. voltage, followed by its inverting into an a.c. voltage (e.g., a three-phase one) whose frequency is strictly proportional to the rotation speed of the rotor 6 which is determined by signals from sensors 17 of the rotor angular position (e.g., Hall elements) making a clearance with an electromagnet 18 held to the rotor 6. The motor armature 2 is of the smooth (toothless) design, which simplifies the dental engine construction, reduces iron losses (which is of special importance at high rotor rotation speeds), decreases tooth ripple and hence acoustic noise. Provision of the skirt 11 contributes not only to better cooling conditions but also effects holding of the front bearing unit to the casing 1 without using screws, bonding with adhesives, etc., thus simplifying the engine production technology and adds to its maintainability.

#### Industrial Applicability

The dental drilling engine proposed herein can find extensive application, depending on the type of working tool gripped in the collet, in medical engineering for dental prosthetics, in jewelry practice for treating and polishing of precious stones, in engraving practice for making patterns on articles, in dies-and-tools production for fine treatment of casting moulds.

CLAIMS

1. A drilling engine, comprising a casing (1) which accommodates a drive electric motor whose shaft (5) is journaled in bearing units (7) and is connected, through a clutch (12), to a collet for gripping the working tool, a  
5 detachable cover (13) with a power cable brought to a wiring board (16) located on the rear bearing unit, CHARACTERIZED in that used as the drive electric motor is a brushless motor whose stack of an armature 2 and a winding (3) are provided with vent ducts and are located on the interior  
10 surface of the casing (1) provided with a skirt (10) that forms a vent duct together therewith, a number of vent holes (16) being provided in the casing (1) and in the detachable cover (13), while sensors (17) of an angular position of a rotor (6) make a clearance with an electromagnet (18) held  
15 to the rotor (6).

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/RU 94/00289A. CLASSIFICATION OF SUBJECT MATTER  
IPC 6: A61C 1/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 : A61C 1/06, A61B 17/16, B23B 45/00-45/14, B27C 3/08

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE, A, 1566265, (SIEMENS AG), 25 January 1973 (25.01.73)	1
A	US, A, 3427720, (HERBERT BERMAN et al), 18 February 1969 (18.02.69)	1
A	SU, A1, 1727796, (KIROVSKY INSTRUMENTALNY ZAVOD "KRASNY INSTRUMENTALSHIK" et al), 23 April 1992 (23.04.92)	1

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understate the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combinations being obvious to a person skilled in the art

"Z" document member of the same patent family

Date of the actual completion of the international search

26 May 1995 (23.05.95)

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15 June 1995 (15.06.95)

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